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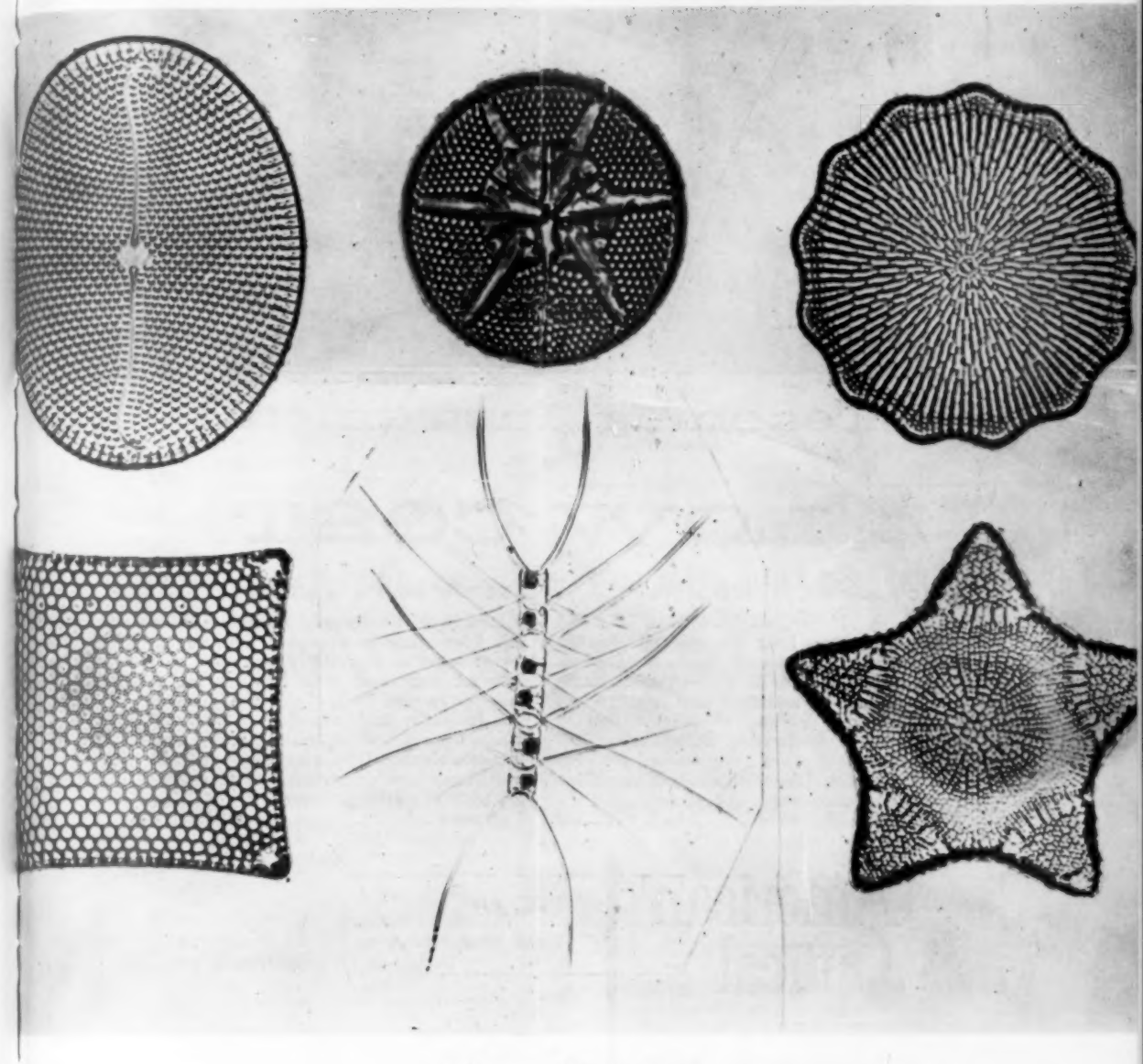
DECEMBER, 1955 VOL. 17, No. 8



Marine Biology

Exploration and Discovery

Index for Volume 17

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Publication of the National Association of Biology Teachers.

Issued monthly during the school year from October to May. Entered as second class matter October 20, 1954, at the post office at Danville, Ill., under the Act of March 3, 1879.

Publication Office—Interstate Press, 19 N. Jackson St., Danville, Ill.

Co-Editors—RICHARD ARMACOST, Department of Biological Sciences, Purdue University, West Lafayette, Ind.; PAUL KLINGE, Howe High School, Indianapolis 1, Ind.

The Purdue University address will be the official editorial office. Manuscripts and all publication material may be sent to either of the Co-Editors.

Managing Editor—MURIEL BEUSCHLEIN, 6431 S. Richmond, Chicago 29, Ill.

Subscriptions, renewals, and notices of change of address should be sent to the Secretary-Treasurer, PAUL WEBSTER, Bryan City Schools, Bryan, Ohio. Correspondence concerning advertising should be sent to the Managing Editor.

Annual membership, including subscription, $3.75, subscription to Journal, $3.75, outside United States, $4.50, individual copies, $.50.

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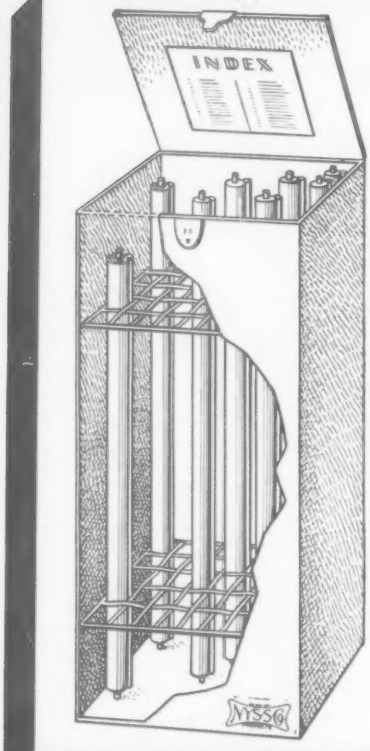
Cover Photograph

These photographs by Dr. Paul S. Conger, Associate Curator, Smithsonian Institution indicate the variety of shapes of diatoms. Upper row, *Mastogloia splendida* (Greg.) Cleve; *Asteromphalus* sp.; *Stictodiscus Eulensteinii* (Grev.) Castr. Lower row, *Biddulphia cuspidata* Janisch; *Chaetoceros altanticus* Cleve, *Biddulphia juncta* A. Schrn. Dr. Conger is working on an interesting article about diatoms which will be published in a spring issue of *The American Biology Teacher.*

Teachers and Students Invited

Teachers and students are invited to send in photographs to be used on the cover of future issues of THE AMERICAN BIOLOGY TEACHER. Please enclose brief description along with each picture.



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Teaching Marine Biology at the Secondary Level

JACK E. MacCURDY
Coral Gables High School
Coral Gables, Florida

The article "Utilization of a Marine Environment in the Teaching of Biology" by H. B. Boer in the May 1955 issue of the American Biology Teacher was unusually interesting at the time because we at Coral Gables High School had just concluded our annual unit on marine biology, and we think the suggestions and bibliography in the Boer article will be of value to us.

Our unit in marine biology, taught for the past five years, has gradually increased in scope until now we are pressed for time in the last six weeks to accomplish all that we would like to do.

The unit consists chiefly of four activities based upon the interests and experience of the students.

First, collecting and the subsequent development of a marine museum so that we can have the actual specimens to study. Students are encouraged to bring in from the nearby beaches and ocean reefs both vertebrate and invertebrate marine animals. The girls excel in shell collections, most specimens being obtained on trips to Marco and Sanibel Island. Fishes are captured by a variety of methods which includes hook and line, nets, and traps. The fish are injected and preserved in 10% formaldehyde, the greatest difficulty being to obtain specimens small enough to fit inside a gallon jar. In fact, small specimens of some fish—such as mackerel, snook, red fish, and bonito are as highly prized as the larger record breaking catches. At the present time our museum includes some 200 different species of marine life. Not only are the common food fishes of the sub-tropics represented, but also the more fantastic creatures such as the sea horse, sargassum fish, scorpion fish, remora, cow fish, trumpet fish, man-o'-war fish, moray, and various gobies and blennies. Sometimes in an effort to "stump the teacher," students go out with commercial fishermen and bring in unusual fish that get caught in lobster traps or turn up in commercial catches. Occasionally the teachers take out small groups with seines and nets, but more often the students take off on their own. They go in heavily for spear fishing, building their own re-breathers, aqua-lungs, and Hawaiian Slings.

The second activity in the unit involves learning to identify the specimens and actually writing up life histories of many of them. In addition students are required to make block graphs and circle graphs on Florida fisheries, showing the catch by pounds and value for each year from 1939 to 1953.

The students get their information by sending for bulletins issued by the Florida State Board of Conservation, the University of Miami Marine Laboratory, and the U. S. Bureau of Fisheries. The teachers can always predict certain reactions. Early in the unit, students who have always looked on the humble mullet as bait will be amazed to learn that it stands first in Florida among food fish in pounds and value. A comparison of their graphs posted on the bulletin board will reveal the decline of the Florida Sponge industry, and the rise of the shrimp catch—indicating the importance of the new shrimp grounds discovered off the Dry Tortugas in 1945.

On the assumption that living marine creatures are more instructive and interesting than dead animals smelling of formaldehyde, our third activity is to keep specimens alive in a suitable habitat. This involves maintaining a marine aquarium. As a matter of fact we keep two aquaria, one 25 gallon, and one 10 gallon, with a third 20 gallon fresh water tank for raising guppies for food. Buckets of sand and salt water are trucked from the beach while pieces of coral rock add the reef touch. Seines and dip nets are employed by certain students after school hours to stock the aquaria. Over-enthusiasm on the part of collectors resulted

Netting Specimens.

Checking the catch.

in the aquaria being over crowded at first, in spite of a rotary air pump and attached water filter.

Strictly by trial and error we found which animals could be kept with a minimum of care in the marine aquaria. For example, sponges, ascidians, and living coral were taboo. They died quickly and fouled up the water. Also barred was the Blue Crab (Calinectes) and the Pin Fish (Rhomboides) because of their aggressiveness. Another resident who wasn't long for this world in the aquaria was the Starfish Astropecten, although another genus, Echinaster, survived very nicely. Pipe fish and Sea Horses had to be kept separate for their own protection. Students observed with interest the antics of a small Octopus and the clumsy Boxfish, the swift slashing attack of a three inch Barracuda when fed live guppies, the tube foot locomotion of Sea Urchins and Starfish, and the bulldozer tactics of the Horse Shoe Crab. Food consisted of the above mentioned guppies (Gambusia) which were easily netted in the canals and kept alive in the fresh water tank. Starfish, Sea Urchins, and Shrimp were easily observed eating dead guppies. Brine shrimp eggs were hatched and fed to Pipe fish, Sea Horses and Cyprinodon (the common salt water top minnow). Water in the aquaria was never changed and as evaporation took place tap water was added to bring it up to the original level.

As a fourth and final activity of the unit certain students in each class volunteered to do extra work in their area of particular interest. A series of fish paintings, from those with artistic ability, added color to the classroom, while shop students in woodworking made respectable models of otter trawls, and lobster traps. Other students gave oral reports on methods of sport fishing and demonstrated the virtues of the spinning rig vs. the casting rod. Surf rods and boat rods were also in evidence, but as usual the skin divers with their aqua lungs, snorkels, and various spear guns stole the show. Incidentally, some rather hot arguments followed regarding pending legislation restricting spear fishermen.

Our unit in marine biology generates real enthusiasm on the part of both students and teachers—this in spite of the fact that it involves hours of overtime and a certain amount of blood, sweat, and tears. As teachers, we found theory to be one thing, actual practice another. We suggest that before any teacher undertakes such a project he should consider the possible following situations. Is his enthusiasm such that he can carry on when the outboard motor conks out with a boat load of teen-agers aboard? Is he stalwart enough to keep going when he's bogged down in mud at the end of a 30-foot seine, neck deep in water with a cool northeast wind blowing? If he still thinks it worthwhile, then perhaps he can do away with the text book and take off on really utilizing the marine environment in the teaching of biology.

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Bulletins:

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2. Biographies of Florida's Important Food Fish, State Board of Conservation, Tallahassee, Florida

Preserving Selected Specimens.

Using Organized Collections for Study.

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State Board of Conservation, Tallahassee, Florida, 1950

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4. The Sea Beach at Ebb Tide, Augusta Foote Arnold, D. Appleton Century Co., Inc., New York, 1940
5. Animals Without Backbones, Ralph Buchsbaum, U. of Chicago Press, Chicago, 1943
6. Wonder Creatures of the Sea, A. Hyatt Verrill, D. Appleton-Century Co., Inc., New York, 1940
7. The Biology of Fishes, Harry M. Kyle, Sedgwick & Jackson, Ltd., London, 1926
8. Florida Sea Shells, Bertha Aldrich and Ethel Snyder, Houghton Mifflin Co., New York, 1936

Books for Biologists

HARE, RONALD. *Pomp and Pestilence*. The Philosophical Library, Inc., New York 16, N. Y. 224 pp., 1955, $5.75

This is a popular book, clear and lucid and highly readable; its subject is of universal interest and ranges from descriptions of the great epidemics and pandemics of the past—smallpox, bubonic plague, cholera, typhus—to the less horrifying but equally deadly modern pandemic of influenza. The author considers the origin and native parasitism and follows the spread of infectious diseases over the world throughout the period of history.

(Continued on page 269)

Ecological Source Material from the County Courthouse[1]

ROBERT A. DIETZ
Department of Science
Troy State Teachers College
Troy, Alabama

Actual group study in the field is an experience which teachers as well as students find stimulating. The ecological study of a limited area is a problem well within the range of the high school student's ability. Sometimes, however, the teacher hesitates to embark on such a study because the available text material is inadequate for his area. Environmental conditions, of course, vary considerably from one part of the country to another, and as a result, ecology is treated only in the most general terms in the usual high school text.

The descriptive study of an area is perhaps the simplest problem which a high school class could undertake. Such a descriptive study becomes much more meaningful if it is used as a basis for comparison . . . but herein often lies the rub. Descriptive ecological studies are not ordinarily part of the high school library. Suppose, however, the area could be compared, not with another area some distance away, but *with that same area a century or more earlier*!

Fortunately, such a comparison—in some degree—is usually possible. Buried in the files and vaults of county courthouses or office buildings are the field notebooks of the various surveyors who have cruised the area, including those of a century and more ago. A surveyor's notebook reflects, in some degree, the personality of the surveyor himself, and reads almost like a diary. This is especially true of the notebooks from the early and middle eighteen hundreds, which are frequently filled with a wealth of vegetation data.

A few years ago the writer became interested in learning the past vegetational history of a small area in Franklin County, Missouri. In the courthouse at Union, Missouri, he found two surveyor's notebooks from the 19th century—one from 1853, and one from 1881. In those days the points of reference used by surveyors were not brass plates sunk in concrete posts. They used "witness trees" which were easily recognizable by their size and position. Some of these witness trees may still be detected today. Both of the surveyor's notebooks at Union contained gratuitous descriptions of the vegetation along the lines which these men ran. These descriptions contained not only the common names of the trees, but as a general rule some estimate of their abundance or prediction of their value. It was fascinating to compare the vegetation of the last century with that of today.

Let's see how one might go about finding and using these old surveyor's notebooks. Prior to asking the records clerk for permission to study the field notebooks, the area to be studied must be chosen and located precisely on the master map of the county. From this master map the township coordinates are obtained, and the notebooks are filed under these coordinates. For example, near Troy, Alabama, there is an interesting vegetation type, a hammock, known locally as the "pocossin." From the master map in the Pike County engineer's office we discover that this area lies within section R-21-E and T-9-N. Proceeding to the records clerk, we explain our purpose and request permission to examine any field notebooks pertaining to this area—particularly the old ones. It has been our experience that these clerks are usually most cooperative after the purpose of the request is made plain, although as a general rule the notebooks must be examined in the office and not be removed from the courthouse.

[1]Contribution from the Science Department of Troy State Teachers College, New series, No. 2.

In the case of the Troy "pocossin," the notebook reveals—in the precise, but spidery script of the nineteenth century surveyor—that this un-farmed, largely un-cut area is just about the same today as it was over a hundred years ago. We read, "Chinkapin tree abt. 2° diam. N. 8 degr. E 4 chains 6 lnks. to small stream. Forest—Gum, wtr. oak, magnolya, willow. N. 5 degr. W up steep incline 8 chains 14 lnks. to large forked chestnut." In 1955 the chinquapins and the chestnuts are gone—victims of the chestnut blight, but magnolia, scrub oaks of various species, and "gums" still characterize the area. The frequent references to "chinkapin" and chestnut trees, however, attests to their relative abundance in times past. Armed with such data, how much more meaningful is the present descriptive study of the area! Indeed, if carefully done, a comparative study as outlined here would add a significant note to scientific knowledge, and might well be worthy of publication.

Another source, sometimes overlooked, is the large aerial photographs available at the county offices of the United States Department of Agriculture, which are used as base maps for soil surveys. These photographs may extend back twenty years or more. To a high school student, a twenty year old aerial photograph is like something out of ancient history. These aerial photographs may be used for tracing out an outline base-map of the study area. If there is a meandering stream or river within the area, however—or even a pond which is becoming filled in—the changes which can take place with respect to the position of the banks are sometimes little short of startling, even in a relatively short span of time. The photographs are quite clear. With the magnifying glass it is possible to locate single isolated trees, which can be used on the ground as reference points.

A comparative ecological study will yield many benefits to the students undertaking such a project. They will learn to use their own knowledge and resources, without recourse to previous studies or specific directions obtained from text material, and yet will be able to present results which are both interesting and significant.

A Terraced Laboratory

W. E. BOOTH, Professor of Botany
Montana State College, Bozeman, Montana

Countless opinions and arguments concerning laboratory and lecture techniques have achieved much to direct attention and effort into improvement. The biological fields have been fortunate that trials and changes have taken a positive but conservative approach, rather than coining new terms which are supposed to herald profound innovations. Too many of these mutations are, under critical examination, only new exaggerations and are doomed to oblivion after the first appeal is exhausted.

In general whether it be the formal laboratory of Asa Gray or the working companionship of student and teacher so common during the beginning of the sciences, the fundamentals are similar. The laboratories are all basic in approach and the instruction has always been in the presence of materials. The only exclusion needed are those courses using a laboratory merely for titular needs.

The patterns of teaching in the biological science courses in colleges are more varied than in high school, but many colleges and most high school biology courses use a combination of discussion, discourse, investigation, and demonstration. With this pattern of combined techniques there has been little choice of rooms. Most teachers however, are aware of the advantage of conducting a lecture, discussion or demonstration where the students are elevated on steps.

At Montana State College the "Ohio State" method of teaching botany is employed. This method of teaching makes use of discussion, discourse, investigation and demonstration techniques in varying proportions during each period. For use in this course a trial laboratory with the student tables on raised platforms was established for use by four of the six sections.

The room was a small lecture room, which after conversion is a laboratory for 32 students. The alteration consisted of building 4 steps 5 feet wide with risers of 8 inches. The tables are 26 feet long, 18 inches wide, and 28 inches high. Electrical outlets are easily available for each student unit. The chairs have a single

tubular leg, a back, and are spaced with an isle of 18 inches between the back of the chairs and the next table.

The advantages of having the students elevated on steps for laboratory work was found to be even more important than steps in lecture rooms. An instructor can observe the activities of 32 students at all times with ease and the students can see demonstrations or the blackboard without the usual dodging and weaving to see around one or more persons in front of him.

Incidents to illustrate the ease in keeping in close contact with the class are many, but two that come to mind are: a request was made early in the course that the students examine slide number 1 under the low power of their microscope. The students started with their observation, but in looking over the room it was observed that one student was attempting to use the high power. In another exercise a number of plants were available for each group of two students for examination. The students were asked to remove a leaf from the geranium plant and tear the leaf in a perscribed manner for examination of the epidermis. The geranium on the instructors desk was pointed out for those not knowing the plant, but upon looking over the room two students were about to remove a leaf from a begonia plant.

To be certain a regrettable tendency of many is to let these students proceed and learn through wrong-doing. Such practice is time consuming and students should not be deserted for the sake of such discipline. Especially where it is important to keep the class together, the work can be facilitated greatly by having each student in full view as he works.

The fear of regimentation of students through unified class activities will be quickly dispelled upon seeing the class in action. There is no pressure to make specific or traditional conclusions. The materials should be examined simultaneously, but the latitude in examination and interpretation limitless.

After using the new laboratory for a period of 3 months, a decision was made by the instructional staff using the room that the advantages were important and an attempt should be made to convert another laboratory used for beginning classes into a similar arrangement. Rooms used for single subject which employ the use of discussion, discourse, investigation and demonstration should receive remodelling consideration. The best opportunity comes, however, to those planning a new laboratory. The cost of the terraced laboratory will be very little more, but the effectiveness will be great.

Teachers Spearhead Conservation

WALTER P. TAYLOR
Visiting Lecturer, Claremont Graduate School
formerly Senior Biologist,
United States Fish and Wildlife Service

What are the teachers doing about conservation?

This question came to me while I was visiting in one of our great cities, with a population of a million or more people. While there I tried to locate somebody interested in what, to me at least, are the biggest problems of the day—land and water use, soil erosion, wildlife conservation, economy in the utilization of strategic materials, saving our national parks and wildlife refuges from exploitation, protection of our last remaining wilderness areas, etc., etc. You can complete the list!

I visited the museum of natural history in this city. Aside from some well-prepared exhibits illustrating the ecological and historical relations of some of the plants and animals, there was little evidence of interest in conservation. Indeed I was directly informed by one of the workers at the museum that there was nobody in the place who was particularly concerned.

I went to the biology department of a great university. There I met with some most estimable gentlemen, evidently of outstanding personality, competence, and capacity, but apparently so much absorbed in the training of premedics and a miscellaneous assortment of undergraduate students that they had little time for conservation. I toured the zoological garden, a wonderfully developed enterprise, with numbers of valuable specimens, splendid buildings and grounds, but no very direct conservation emphasis.

This was a bit discouraging, for I remember that, at the very time I was prowling around the city in question, the Dinosaur National Monument had been threatened with invasion and commercialization; that the Defense Department was trying its best to take over 11,700 acres of the Wichita Mountains Wildlife Refuge; that wilderness areas in Oregon and California were in danger of impairment or even elimination; and that grazing and mining interests in many places were pushing hard against the moderate restrictions set up by Congress to protect the interests of the general public.

Admittedly I did not make an exhaustive study of the local situation nor did I have time to canvass all those who may have been interested. From the silence of the newspapers on the subject, however, and some of the indications mentioned above, it seemed obvious that the local consciousness of what is happening to our country, conservation-wise, north, south, east, and west, was at least not very keenly developed!

And then, in my chip-on shoulder survey, I ran into an old colleague of mine formerly in the Biological Survey in Washington. We found ourselves in agreement on the conservation issues of the day, and enjoyed commiserating about the sad state of affairs and the widespread lack of interest in conservation problems of state.

"*What about the teachers?*" *I asked my old colleague.*

"*Ah, there's a fine crowd,*" *answered he.* "*They are really working and doing a fine job.*"

This was most edifying. Maybe we are getting away from the deadly dull bookish type of biology instruction as unrelated to life as a mausoleum. Perhaps we are improving in our demonstration to our pupils and the public that of all possible subjects in the curriculum, biology is the most vital and significant for the welfare of mankind.

About this time I could not help but be more than ever impressed with the opportunities, especially for biology teachers, to tackle a real job of reconditioning not only their pupils and students but also the community itself, in knowledge of the natural resources on which we all depend so completely.

With the terrific shift of populations from the country to the city it is perfectly clear that the responsibilities and the opportunities of teachers at all levels are correspondingly increased.

Unless inspired teachers, outdoors minded, obsessed with the intimate and important interrelationships of animals (including man), plants and their surroundings, take occasion to breathe an appreciation of the outdoors into the thousands of ecological illiterates among the city children, and the adults too, our future will not only be less secure, but a whole lot less interesting!

In order to be qualified to impart the essential inspiration, all teachers should be campers and informed conservationists. All should supplement their background information in the natural sciences and related social sciences by special training in this field. Conservation workshops, fortunately, are springing up in various places. Additional courses in resources are cropping up in some of the colleges, and a number of our leading universities have organized departments of conservation.

Almost as I write this there has come to my desk a four page pamphlet, "California A-Flame" telling the story of forest fires in this state between August 27 and September 13, 1955. Fires, 436 in number, burned in the forest and watershed lands during this two week period.

"Visualize a 3-foot boardwalk 60,000 miles long—long enough to stretch twice around the world at the equator with some to spare." Such a boardwalk could be constructed with the timber that was burned in California forests during 15 days.

"The ability of all of the burned over lands to function properly as a watershed has been seriously impaired. Certainly homes, roads, orchard groves and other improvements lying in and below the burned areas will be subjected to an almost inestimable amount of damage from floods and erosion in the months and years ahead. The extent of this damage will depend on how fast the rains come and how fast a protective cover can be restored on the burned-over lands."

This is the kind of thing we face in the conservation field, indeed, in the business of living in our modern precarious world. What are we teachers, going to do about it? The business or other types of professional men will

never do the job; the farmers are not prepared for it; the sportsmen will help, but they will need assistance and sympathetic guidance; skilled and unskilled laborers cannot, in the nature of the case be counted on. The teachers seem to be *it*. By judicious preparation for and leadership of a campaign of public education, in diplomatic cooperation with all the other groups mentioned, the teachers can make a larger and more significant contribution than ever before to man's vast future in the United States of America.

I Am the Science Teacher

JAMES R. IRVING*

Somewhere in America, today, I plant an idea that may well influence our civilization twenty, thirty, forty, fifty years from today . . . maybe, just a few years from now.

Somewhere in a classroom this morning or perhaps this afternoon in a laboratory, I am guiding a thought or a hand that will someday hold the surgeon's scalpel, the fate of a vicious disease in a test tube, our technological destiny . . . a world of nuclear power for mankind's edification and benefit.

Somewhere in a school, today, my own love for my subject might well cast a spark into the tinder of a boy's or girl's mind. He or she, too, will then reap the boundless satisfaction from examination and study of the world around them.

Somewhere in the quiet of my office, tired after the day's work, the enthusiasm that I show—the answer that I give—could easily be the turning point in the life of that freckle-faced boy. For bad or for good . . . a life of contribution, or one of mere existence.

Somewhere among the laboratory benches of our nation's schools, as we look through the eyepiece of a microscope, confirm Ohm's law or watch the brilliant flash of magnesium ribbon, I alone am responsible for the degree of impact of these experiences upon the observer's mind . . . whether they care about it . . . whether they remember a part of it . . . whether it's just another "laboratory exercise."

Somewhere, today, in one of America's classrooms, I have the privilege of enhancing young people's awe and reverence for a Supreme Power—God—in whose image they are created. Mine is truly a magnificent and splendid work. For he who thrills to the wonders of himself and the universe about him takes from that experience a greater reverence for Him.

Somewhere, today, I am guiding the learner's mind to the beautiful realization that scientific progress is evolutionary rather than revolutionary in character . . . that nuclear energy concepts of this moment began with Thales' observation 556 B.C. and before . . . that each searcher for the Truth slowly and laboriously adds his bit to the Log of Truth until periodically, one of us is given insight into the cumulative value of such isolated observations—and ways of the universe are changed overnight.

Somewhere, today, let me call attention to the actual feebleness of man's unaided senses . . . that we alone cannot see so many of the world's beauties with the eye; that much of God's music is never heard; that many times forces we cannot feel predestine our existence; that taste and smell are many times muted to our environment.

Somewhere, today and every day, mine is the constant thrill of having to completely change my own thinking because of a new discovery in the research laboratories of the world. Mine is the satisfaction of a dynamic teaching life—a mind constantly in quest of the Truth.

Somewhere, . . . maybe today or tomorrow, but sometime before they leave me—I must lead my students to an appreciation of the power of humility . . . an element as closely entwined with the science scholar's soul as the love of search itself.

Somewhere, today, boys and girls will love science.

I am the science teacher!

(Reprinted from the May, 1955, issue of The American School Board Journal

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Opportunities for Exploration and Discovery

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The work in biology at Carmel High School is based on the naturalist's philosophy that it is vastly important for students to study living organisms; that the indoor laboratory and the out-of-doors are available for the purposes of fostering the spirit of inquiry and arousing enthusiasms for learning.

If students are to understand the environment in which they exist as a part of the living world and as a member of a complex social organization, each student must gain his knowledge of the land and its changes from first-hand experiences. In biology there is an opportunity, as in no other field, to help the student recognize some of these problems, to observe, gather and record data carefully, set up and test his hypotheses and then arrive in some measure at a tentative conclusion that is reasonable, if we, as teachers can provide the challenge! The student's eagerness, enthusiasm and diligence know no bounds when he is given an opportunity to find out for himself. Ninety per cent of the values in study out-of-doors comes from discovery and first-hand acquaintance by the individual who goes out to observe. To the teacher who provides these opportunities comes the unmatched satisfactions in the realization that she is meeting the fundamental needs of the individual as he explores and experiences the thrills of first-hand discovery.

We have provided such opportunities at our high school. Our Board of Trustees listened to our plea and set aside for us a natural area of 2½ acres of unused land on our campus for the study of living plants and animals and their communities, under conditions that free the land from man's disturbance insofar as is possible. We were fortunate in having as an inspiration for our work the kindly guidance, counsel and leadership of one of America's most outstanding students of natural history, Dr. J. M. Linsdale.

The biology students who were instrumental in helping set aside this acreage gathered in groups and outlined a flexible yet long-range program of study. They wished to study the

Dusky-footed Woodrat (*Neotoma fuscipes*). Courtesy of Lloyd P. Tevis, Jr.

This is the Packrat of California which builds conspicuous houses of sticks in the chaparral.

nature of soils and the effects of weather upon it; and at what rates plants grow? What kinds of plants and animals live in an acreage of this size? What interdependence of plants and animals can we discover? How can gully erosion be prevented? These were a few of the problems they suggested.

A film of our classroom and outdoor activities was taken, developed and printed by our principal, Warren W. Edwards at a cost of $30.00. The story of the film began after initial group planning and after student-teacher conferences in which the individual problems were formulated. Each student prepared a careful outline of the problem and of his work before he went into the field.

The following paragraphs contain the commentary which accompanied the showing of

this film at the AAAS meeting at Berkley, December 28, 1954.

The story begins after this initial group planning and after student-teacher conferences in which the individual problems were formulated. Each student prepared a careful outline of the problem and his work before he went into the field.

The campus at Carmel High School is spacious. It faces the Carmel Valley where the Santa Lucia mountains of Monterey County meet the Pacific.

Senior students, enrolled for their third year of Biology, arrive and enter the classroom where laboratory work on their out-of-door problems is underway.

The setting aside of our natural area received community support and was featured in our local newspaper.

Our first task involved bounding the AREA, mapping and fencing. A directional marker was set. Geometry as a study took on new meaning and importance when its principles were put to use.

Within its boundaries on an east-facing slope are three major plant associations: open grassland, a small forest of Monterey pine trees, and between these, an irregular strip of chaparral made up of California sage, coffeeberry, coyote brush, live oak and Ceanothus.

A weather station was purchased by our Superintendent from War Surplus. It was assembled and set up by two members of our Biology Class. The station faces directly north and its floor is 4½ feet above the ground. Howard is the weatherman.

He planned his weather recording sheet and took full responsibility for keeping the readings. He entered the classroom and immediately went to the barometer on our wall for his first reading and recording. He left the classroom and walked 400 yards to the natural area where the other instruments were set up in the weather shelter. The instruments were read at the same time each day.

Reading the maximum-minimum thermometers
Setting the maximum-minimum thermometer with a magnet
Wet-dry bulb thermometers must be fanned to give an accurate reading
Filling the wet-dry bulb wind velocity gauge
Reading the rain gauge
Weather vane, designed by Howard and made in our shop
Installing the weather vane
SUMMARY

Each month a summary of the weather data was figured and recorded. These findings answered, in part, some of his questions. How much rainfall? How many cloudy days? How many sunny days? Which months in the year are most free of fog in Carmel?

This out-of-door work brought him to the point where he recognized his own need for reference reading. He had been little interested in books up to this time. Stewart's STORM delighted him; he asked for more. He read Miller's WIND, RAIN AND STORM, and Vetter's VISIBILITY UNLIMITED.

Bill chose to study the rate of growth in heights of Monterey Pine seedlings. We have his record of the growth of five pine seedlings over a period of 1½ years. He was interested in discovering that their growing season paralleled the rainy season which was recorded on the weather charts.

The growth of the seedlings was plotted in the laboratory from the figures he recorded in the field.

Francis made an extensive study of the wood rat. We are fortunate in having this mammal established in our area. Francis located nine of the pyramidal houses of sticks built by the rats. These are often located in impenetrable tangles of dead branches of shrubs. He measured the diameters and the heights of these houses at frequent intervals in order to determine the rates of increase in size as sticks are constantly being added to an occupied house. He studied the trails and followed their course from house to house. Wood rats are great visitors. Three individuals were live trapped and brought into the laboratory where they were accurately weighed and then returned to the site of capture and released without harm or undue fright. Subsequently, these animals were recaptured and reweighed; their gains or losses computed. THE DUSKY-FOOTED WOOD RAT by Linsdale and Tevis served as a source of constant reference. Francis compared what he found in our AREA with the scientific

studies recorded in this book. Although the wood rat is nocturnal, Francis was successful in live trapping during the day.

Melinda and Susan worked for part of the year on the beginnings of our collection of plants for our reference. All collections are made outside of the boundaries of our area in keeping with the principle of maintaining a natural area in an undisturbed condition. Field data: date, locality, collector, soil type, exposure, are recorded with each specimen in the field at the time of collection. The plants are pressed between standard blotters, mounted on regular sheets of herbarium paper, labelled and sorted to family and genus. Susan worked with Jepson's MANUAL and made progress in identification.

What is soil? Are there different kinds of soil? A study of soil fascinated Susan. She prepared a soil profile by making a vertical cut 15 inches deep in the ground outside of the natural area. She measured the depths of each layer and was amazed to see the narrow margin of topsoil.

She tested soils from five selected locations for acidity-alkalinity and for nitrogen content. For these tests she used LaMotte, Morgan type, equipment.

She planned an experiment under controlled conditions to test the effect of degrees of acidity of these soils on the growth of bean seedlings.

What vertebrate animals live in our AREA? Tam and Melinda observed birds throughout the year and each student kept a field notebook on special 5½ x 8½ ruled paper. The notebook record is made at the time of observations in the field. Binoculars are useful. These were purchased from War Surplus and were inexpensive. A watch is necessary for the observer to record flights, lengths of time of calls, foraging periods and feeding of young.

The object of the record is to write clearly and understandably of what one sees. This is far from easy Penmanship and written communication improved as the work progressed.

From their observations we have prepared a record of 45 species of vertebrates in our area. More important, though, are the records of what the observers saw these animals doing. Their descriptions are sufficiently adequate for positive identification of birds. We have one exciting record of Bullock orioles driving a Red-tailed hawk out of the AREA.

Our reference books are original scientific studies insofar as possible, not texts. We assembled a book, Vol. I, as a permanent record of our work. Each student wrote up his own chapter and aided in the editing.

From time to time each student shared his discoveries with his classmates. Interesting discussions invariably followed.

At the close of the term we gathered to evaluate our wonderful experience.

I asked them two questions: first, what had these experiences done for them individually? and second, what had been the role of the teacher?

I wish we had the recording of their own voices on this film. The students were unanimous in their enthusiasms to explain that this experience had given them INDEPENDENCE. It had given them FREEDOM with RESPONSIBILITY. It had given them a sense of SECURITY which they had never before experienced. It had widened their range of KNOWLEDGE. It had RELEASED them from tensions of competition. It had given them ENTHUSIASM FOR STUDY.

They depended on their teacher not for answers but for more questions. When they came for help, we sat down as friends and talked out the problem from their points of view. Each student understood that this was HIS PROBLEM, not the teacher's and that the responsibility rested with him to work toward a solution. As the teacher, I could point out, only by asking further questions, possible ways of approach. The choice of procedure was his.

This type of teaching resulted in unfolding of personality growth and development. One student gained in self-esteem and self-confidence to the extent that he earned almost straight "A" throughout his entire senior year. His physical health improved. One student decided to enter the teaching profession.

Academically as to the values of this year: all I can say is, that two of the problems undertaken in this course were awarded honorable mention in The Future Scientists of America program sponsored by NSTA and The American Society of Metals in 1954.

Vitalizing Biology With A Live Animal Project

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This article outlines a group of experiments illustrating the use of a live animal project in teaching elementary, college biology.

Since these projects were conducted on the college level in a biology survey course, a brief description of the course is given. Biology which is a part of general education at Albany State College is required of all students. It extends over two quarters and its total credit value is ten quarter hours. In the conduct of the course, time is alloted for student laboratory work—the main core of which is *not* "dissecting and drawing."

Textbooks, selected laboratory work, group discussions, periodical reading list, library assignments, and an extensive use of audio-visual aids comprise the major working tools of the course.

The nature of the course and the frequency of distributions of topics listed for study follows the pattern for such courses as indicated by the studies of Goldsmith (*1*), Miller (*2*), Bullington, (*3*), Andrews and Breukelman (*4*).

At least two points in the writer's thinking give ample latitude for such a project:

1. At the secondary level students have had very little if any contact with live animals in the laboratory. Abbott's (*5*) and Cole's (*6*) articles both give support to this idea.
2. By becoming a working part of such a project, students are given the opportunity to get practice in problem solving and to develop an understanding of how the scientific method works.

The impetus for starting our animal project or "Operation Rat House" was gained from questions raised by students during a class discussion.

The topic of discussion centered around thirst, hunger, diet, essential foods and vitamins. The determination of what foods were essential for good nutrition led to a discussion of the use of laboratory animals in testing food nutrients. Questions which were frequently asked were: "Why are albino rats almost always used for dietary studies?" "Could white mice be used to the same advantage?" "What are the differences between white mice and rats other than size or species?" "Could we raise a few of both in this course as a project?"

This show of interest and curiosity led us to believe that a live-animal project might be worthwhile. The project of animal breeding was started by obtaining a pair of albino rats, albino mice, and chocolate mice. Each pair contained a virgin female. Groups of students were selected to care for the animals. One group for rats, another for mice. Eventually such chores as filling water fountains, feeding, cage cleaning, weighing and recording animal weights, were experienced by all. The fecundity of the rodents soon had us looking for space to house our cages. Fortunately an unused store room was found and converted into an animal house.

Listed below are the experiments carried out:

1. *Nutrition Experiments Using Balanced and Deficient Diets.* Since the literature concerned with the dietary requirements of the rat is so voluminous, the purpose of this segment of our work should be clarified. The core purpose of our dietary experiments using the albino rat was to give the student a tangible understanding of the role of diet in maintenance of normal physiological functions, and a recognition of a deficiency symptom.

Commercially prepared diets both sufficient and insufficient were used. A few animals were divided as to sex and weight and placed in control and experimental groups. Our con-

FIGURE 1. A student and laboratory instructor feed and water experimental animals.

cern was nutrients provided in the basic foods, vitamin A and B and a mineral sufficient diet consisting of basic minerals without trace needs. Other interesting results were obtained by using protein, carbohydrate, and fat diets over a six weeks period. Pictures were made at the end of the dietary experiments.

A working understanding of the relationship of copper to iron in hemoglobin formation was achieved by feeding rats a diet of skimmed milk which produced nutritional anemia, milk being deficient in both copper and iron. Because this study was not quantitative, blood serum or mineral analysis was not necessary. No post mortem examination of tissues was made. We were content with such symptomology as stunted growth, swelling of the abdomen, weight loss, disturbances of the eyes, loss of vigor, and unhealthy appearance of hair coat.

Since these feeding experiments demand weighing animals and record keeping, it affords a practical approach to developing an understanding of an important step of the scientific method, that of collecting, organizing, and coordinating data of the experiments for the purpose of discovering relationships. Photographs were made of animals from both groups which served for records and to show finer points of comparison. Directions for carrying out these experiments were gained from a booklet, entitled, *Laboratory Experiments in Nutrition* which was secured from the General Biological Supply House, Chicago, Illinois.

2. *Dissection of Diaphragm.* This dissection, made by the instructor, gives an excellent chance for students to see the location of the diaphragm and to get a clearer concept of its function in animal respiration.

3. *Reproduction and some Associated Terminology*. Some aspects of the reproductive process, along with associated terminology such as gestation, parturition, ovulation, and estrus cycle, may be well shown with the rat project.

Starting with a few males and females, averaging better than three months in age, breeding can commence. Pregnancy can be detected in about two weeks by noting an increase in size of the abdomen and contrasting the weight before mating with the weight after two weeks. The gestation period extends over a period of about twenty-one days.

FIGURE 2. A student clocks increase in running activity of a rat.

If the animals are being bred with the idea of having several litters it is likely that parturition will be observed.

Understanding Estrus—Students may get some idea of cellular changes in the vagina which are associated with the cycle by searching several vaginal smears taken at different time intervals. The shape of epithelial and cornified cells are different enough to be observed by students not trained in histology. Smears showing a good amount of cornified cells is an indication of the onset of estrus.

This demonstration should be regarded as a special project for the instructor. It should be undertaken only when the instructor has time to make necessary preparations.

Activity and Estrus. Farris (7) has shown that variations in the running activity of the rat to be an accurate method of determining the onset, regularity, and extent of estrus.

By caging several virgin females and placing each for a time in the revolving drum we are able to clock increases in running activity which we regarded as a sign of estrus. (Figure 2.)

4. Reproductive Organs

Observations of Rat's Ovary (Instructor Demonstration)

An ovary from a female rat was removed under anesthetic, placed in saline solution in a watch glass and observed microscopically under low power or with 3.5 or 6x objective if such is available. The rat need not be sacrificed for the wound may be closed after the operation with a wound clip.

Observation of Rat Testis for Shape of Sperm

A mature, anesthetized male should be used for this demonstration. The testis, upon removal can be placed in a small beaker containing saline. One testis should be split in half, placed in a small amount of saline and centrifuged. With a clean pipette, spread a bit of clear substrate, mount, stain with methylene blue and observe. Note shape of sperm head.

5. *Heredity Study*

In pairing off a pair of virgin female albino mice with chocolate colored mice, and placing a cigar box with an open end in the cage, breeding should take place. By mere observation and periodic checking during the course,

the student can get first hand understanding about genetic ratios and the simple facts of heredity.

6. *A Study of Blood Smears Using the Tail of Mice*

In the study of a unit on blood it is always helpful to use freshly prepared smears. Good thin smears can be made by first cleaning an anesthetized albino mouse's tail with cotton saturated in 70% alcohol then gently massaging it to increase blood flow in the tail region, and with scissors clip a tip from the tail of the animal. After the smears are made, by using a little pressure with the alcohol saturated cotton, the wound may be cauterized and the animal is ready to be caged. To prevent cannibalism, it is best to place animals in separate cages.

A comparative study of blood smears, including mice and other animals may give the student some idea of species widely separated as to evolution.

These experiments can be used as class supplements, which may not be completed in a single period, but which can be useful to industrious teachers who are interested in developing a functional approach to biology in general education.

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Biology in the News

BROTHER H. CHARLES, F. S. C.
St. Mary's College
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PROWRESS OF ANIMALS, LEAPING AND RACING *Life*, Oct. 10, 1955, pp. 68-72.

Pictures and charts of the longest jumps and top speeds on record. Good bulletin board material. At least two copies should go into your permanent files.

HEART ATTACK, *Life*, Oct. 10, 1955, pp. 150-159.

Coronary thrombosis is the biggest killer of people in the United States today. Wonderful pictures and explanations of how it happens and how the heart mends itself. Good bulletin board material.

WOODCHUCK! IT'S WAR, BILL WOLF, *Sat. Ev. Post*, Oct. 8, 1955, pp. 47, 130-132.

Persons who have never seen a groundhog, as the woodchuck is commonly called, know that it comes out of its hole and looks around on February second. Does it? This is an account of the habits and methods of hunting the groundhog.

A PLEA AGAINST BLIND FEAR OF CANCER, DR. GEORGE CRILE, JR., *Life*, Oct. 31, 1955, pp. 128-142.

A controversial article suitable for reading by students with excellent judgment. This should be read after reading the comments by cancer experts.

COMEBACK IN THE WOODLANDS, *Life*, Oct. 31, 1955. pp. 110-119.

A digest of a late bulletin from the U. S. Forest Service. We are now growing more

(Continued on page 272)

Outdoor Education at Concordia Teachers College

JOHN W. KLOTZ

Getting ready for a day in the field.

Concordia Teachers College, River Forest, Illinois, carried out a unique and successful program of outdoor education in cooperation with its training school and with the Forest Preserve District of Cook County during the spring and early summer of 1955. From May 16th to May 20th the eighth grade of Grace Lutheran School, the training school of the College, spent a week at Camp Sagawau in southwestern Cook County, and from June 20th to July 1st a two week workshop in Outdoor Education was conducted for teachers and future teachers. The first week of the workshop was conducted at Camp Sagawau; the second week on the college campus. Both programs were somewhat experimental, designed to take advantage of the unique facilities and opportunities available.

Although most authorities recommend the sixth grade as the ideal group for a school camping experience, it was decided to see what results might be achieved with an eighth grade group. The experience fully justified the experiment, and the general consensus was that the group was well chosen. The program was under the direction of Mr. Victor Waldschmidt, principal of Grace School and supervising teacher of the eighth grade. Because of the close connection between Grace School and Concordia Teachers College which trains teachers for the Lutheran elementary schools, it was possible to involve four student teachers in the experience and to utilize part time the services of a number of other teachers in training. In addition the author assisted in the planning of the program.

In preparation for the week of camping, the pupils were told what they might expect and what to bring along. In addition, a special meeting was arranged with the parents of the children to explain the program to them. A special effort was made to make it clear to both pupils and parents that this was to be an educational experience, not just a week of camping. The program was operated on a cost basis. Each pupil was asked to deposit a sum of money, part of which was refunded after the exact costs had been determined.

A copy of the week's program is shown in Table 1. Though it was not possible to follow this schedule exactly, it was possible to come reasonably close to the program planned.

Table 1—A Week of School Camping.

	Monday	*Tuesday*	*Wednesday*	*Thursday*	*Friday*
A. M.	Travel, Rules and Restrictions. Make beds, etc.	Devotion. Aquatics (field trip)	Devotion. Insects, reptiles, and mammals. Language.	Devotion. General field trip for summary. Language. Painting and sketching.	Devotion. Birds and bird life.
P. M.	Wild flowers (field trip) Astronomy	Set up aquatic materials collected. Trees (field trip).	Soils (field trip). Mathematics (measuring, ratios, etc.). Art. Informal Recreation.	Review. Set up exhibits. Prepare for parents' night. Informal recreation.	Clean up camp. Travel.
Evening	Planned recreation. Astronomy.	Planned recreation. Astronomy.	Planned recreation. Astronomy.	Parents' Night.	

Three of the four student teachers who participated in the program were also enrolled in the author's "Nature Study" class. They were asked to assume major responsibility for the outdoor phases of the program. Each conducted a field trip, one in which special emphasis was placed on trees, one in which special emphasis was placed on wild flowers, and one in which special emphasis was placed on soils and rocks. In addition these students served as resource persons in the several science areas. The one student teacher who was not enrolled in the "Nature Study" course was asked to direct the language arts program, and also assumed responsibility for the astronomy work.

In addition to the student teachers, the art program was conducted by a student from Concordia Teachers College, and the recreation program was directed by several Concordia students. Moreover, every student of the "Nature Study" class was required to visit the camp and observe its operation.

The climax of the week was the Parents' Night program. Under the direction of the student teachers, a Nature Trail had been worked out in the camp. Each child took his parents along the Nature Trail in the course of a tour through the camp as soon as the parents arrived. The formal program of the evening was conducted in the spacious Lodge. It consisted of demonstrations and discussions of the work that had been done during the week. Following this the recreational program of the week was presented and demonstrated. Parents participated in some of the games. The evening was climaxed with a devotional address by Dr. O. A. Geiseman, pastor of Grace Church.

The experience was valuable not only to the children but also to the student teachers. Following the week in camp, an evaluation meeting was held in which all who had been associated with the program participated. Strengths and weaknesses of the program were discussed. The student teachers were much impressed with the possibilities of school camping and what it can do for a group of children. They were also amazed at the amount of planning and the work involved in carrying out a program of school camping.

How did the children profit from the program? In general they became acquainted with the out-of-doors. Trees, wild flowers, rocks, insects, birds, and the like became familiar to them in varying degrees. Parents were pleased when their children took them along the Nature Trail, identified the various forms, and were able to tell them something about each one of them. Work in astronomy that was not possible in the classroom was possible in camp. In addition, the children became generally more observant. They saw things around them that they had never seen before.

Undoubtedly one of the chief benefits of the program was the experience of living together. This was mentioned repeatedly in the children's own evaluation of the program. The experience was a climactic one in their elementary school experience, and gave them a great deal of group unity. It was for that reason that the choice of an eighth grade group seemed a particularly fortunate one. This unity showed itself for the rest of the year and was very marked at graduation when there were real tears shed by the parting classmates. The particular oneness of the class was notable, and it seems that the school

Table 2—Outdoor Education Workshop Program.

	Monday	*Tuesday*	*Wednesday*	*Thursday*	*Friday*
First Week		Bedrock. Soils. Wind, Water, and ice deposits	Camp Field trip: trees and wildflowers	Aquatics	Field trip to Little Red School House
	The school camping movement. How to set up a camp. Survey of the program. Projects.	Fossils	Trees and wildflowers: general relationships	Fish and fish management problems. Aquatics in the classroom	Reptiles and mamals: general relationships. Return to campus.
	Audio-visual materials. Devotion	How to identify stars: star maps. Devotion.	Audio-visual materials Devotion.	Student planned entertainment. Devotion.	
Second Week	Indiana Dunes	Work on projects.	Starved Rock.	Work on projects.	Field trip along railroad track. Evaluation.
		Birds and insects: general relationships.		Field trip along Oak Park spit and through Forest Preserve.	

camping experience was particularly important in developing that spirit.

The second phase of the Outdoor Education program of Concordia Teachers College was a workshop in Outdoor Education conducted by Dr. Herbert H. Gross of the Geography Department and the author. This was attended by a number of teachers from the field as well as by teachers in training. Students were enrolled from Illinois, Virginia, Arizona, Texas, Indiana, and Michigan.

The trip to camp was made by bus giving an opportunity for a landscape reading demonstration. The route followed led along the old shore of glacial Lake Chicago, over the spillway to Mt. Forest Island, and down the second spillway. The Valparaiso moraine was pointed out and studied.

The program of the two weeks is presented as Table 2. The first day was spent in discussing the school camping movement, the setting up of a camp, field trips, and methods of outdoor education. Each student was asked to participate during the week in the various camping routines to give him some familiarity with these.

The second day was devoted to soils and soil formations. Students were taken to a quarry where they were able to see bedrock. From here they were taken to a loess deposit (wind), to a gravel pit on an old river terrace (water), and to a glacial deposit (ice) where they could see the unsorted nature of the till. On return to camp, they were asked to collect fossils from the stream running through the camp, which was unusually rich in fossiliferous rocks.

The evenings were divided between planned recreation arranged by the students themselves and the display and demonstration of audio-visual and related materials. In addition students were given information on sources of audio-visual, laboratory, and display materials.

Wednesday was devoted to a tour of the camp with emphasis on wild flowers and trees. The particular objective was to show the wide variety available in a small area, to give some information about the plant and its relationships with other plants and the inorganic environment, and to learn to recognize as many of the trees and wild flowers as possible.

Thursday morning was spent at a nearby quarry, studying fish and aquatic life with dip-nets and seines. Fish and aquatic life, fish management, and related topics were discussed in the afternoon.

Friday morning was devoted to a tour of the Little Red School House, the newest educational venture of the Forest Preserve District. Here an old one-room rural school has been rehabilitated as a trailside museum. The students were able to observe and study the exhibits in the school house proper and were taken along the marked, nature trail. The afternoon was spent in an evaluation of the week's work, and then the group returned to the college campus.

Monday of the second week was spent at Indiana Dunes State Park. Physiographical and biological phenomena were called to the

attention of the students along the way. At the Dunes, the sand succession was described and demonstrated. In the afternoon a different type of vegetation was observed during a trip through the swamp. A trip through the pinery gave an opportunity to discuss relict vegetation. The blowout was used to show and discuss the action of a moving dune.

Tuesday afternoon was spent in a discussion of insects and reptiles in their relation to man. Suggestions were made regarding collections and how to keep these forms alive in the laboratory.

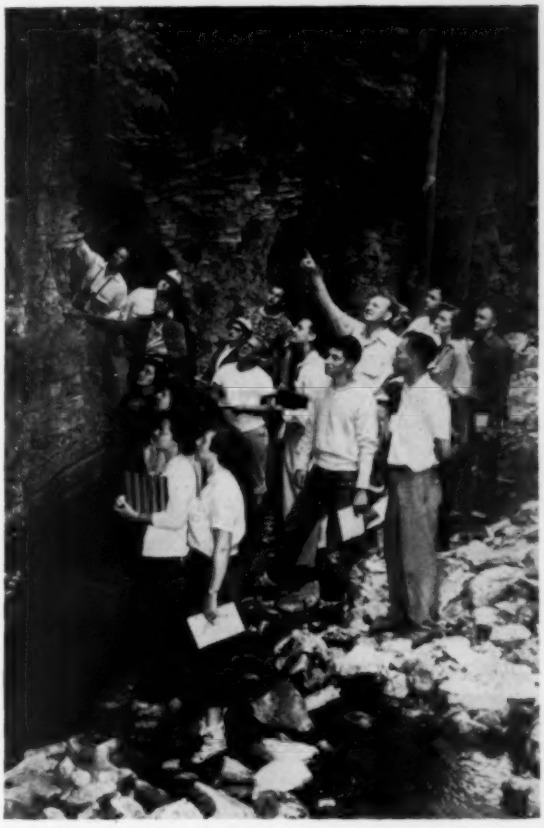
Wednesday morning the group left for the Starved Rock area along the Illinois River Again physiographical and biological phenomena were discussed as they presented themselves along the way. A stop was made at a strip coal mine near Morris. Here the slag pile yielded a number of plant fossils, and opportunity was given to observe a clay-gravel succession with its poplars, black locusts, and white sweet clover.

In addition to Starved Rock, Bailey Falls and Matthieson State Park were visited. The former is a natural falls formed by Bailey Creek as it cuts its way down to the Vermilion River through limestone. Matthieson State Park is an example of a canyon formed in the St. Peter sandstone.

Thursday was spent in studying the nearby shore of glacial Lake Chicago and the famed Oak Park spit which serves as a watershed between the Mississippi drainage basin and the Great Lakes drainage basin. This spit, located only a few blocks from the college, is one of the lowest divides in the world.

Friday morning was spent in a study of a nearby railroad track to demonstrate the wide variety of wild flowers brought in by trains. About a half mile of track was covered, and in that area 102 varieties of wild flowers were identified.

In addition to participating in the program outlined above, each student was required to prepare and carry out a project. Several students carried out soil testing projects. A number of students made rock collections, leaf collections, and weed collections. Another project was the development of a self-guiding nature trail. Several students set up and maintained classroom aquaria, drawing descriptive posters for use in the classroom.



Studying vegetation on the canyon wall.

Both camping experiences proved to be unusually rich and worthwhile. It is planned to repeat the program again next year.

BOOKS FOR BIOLOGISTS

(Continued from page 253)

STORER, JOHN H. *The Web of Life*. Devin-Adair Company, New York. 144 pp. 1954, $3.00

The *Web of Life* will reveal to you how the natural world operates, without benefit of man and his machines. It will show you the natural community in action, with all its parts functioning. It is essential reading for everyone interested in conservation and natural history, and in the wise use of our soil, water, forests and wildlife.

NICOLA, ETHEL AND WITTE, D. *The Rabbit With A High I.Q.* Teachers College, Columbia University, New York. 30 pp., 1955, $0.40

This little booklet will tell you what to do if you have a "rabbit" with a high I. Q.

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BIOLOGY IN THE NEWS

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KING OF THE PESTS, NORRIS LEAP, *Sat. Ev. Post*, Oct. 15, 1955, pp. 53, 142-147.

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HOW EMOTIONS CAUSE UNNECESSARY SURGERY, ALICE MULCAHEY, *Cosmopolitan*, November 1955, pp. 20-24.

Many emotions cause bodily pain acute enough to fool even your doctor. Operations are frequently performed on neurotic persons which give them no relief. Such operations may be avoided if certain neurotic tendencies are controlled in young people.

SAVAGE KILLERS OF AFRICA, DANIEL P. MANNIX, *Sat. Ev. Post*. Oct. 29, 1955, pp. 45, 54-56.

Fierce wild dogs which roam in packs are the most damaging predators in Africa. They attack any animals in their region, even chasing lions away from their kill. They are not easily tamed.

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BOOKS FOR BIOLOGISTS

(Continued from page 269)

SAUNDERS, H. N. *The Teaching of General Science in Tropical Secondary Schools.* Oxford University Press, New York, 375 pp. 1955, $2.00

Although this book is intended to give particular help to the teachers of science in tropical secondary schools, it should interest teachers and teachers-in-training in temperate and torrid zones as well. The author of this book discusses the selection of subject matter, the arrangement of the syllabus, various approaches to science teacher-pupil difficulties, evaluation of the results, and laboratories and their equipment. Contributing to the usefulness of the book are the appendixes which contain a great deal of everyday information.

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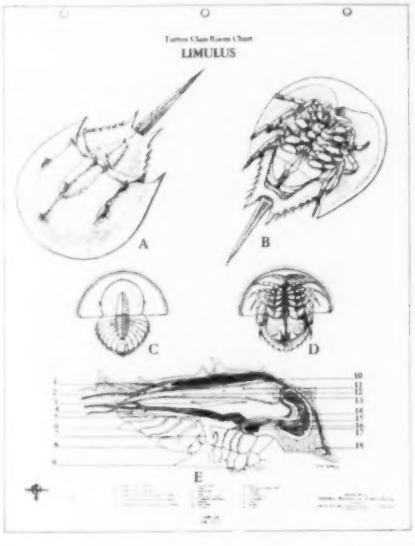

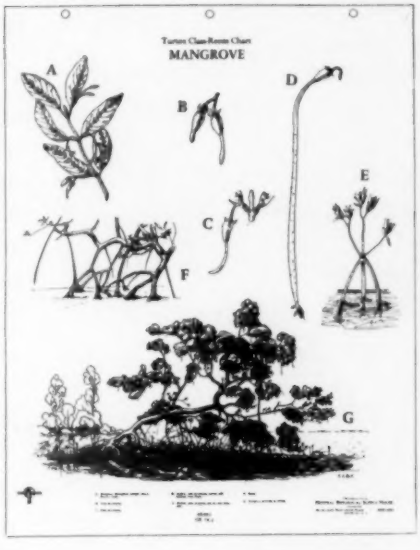

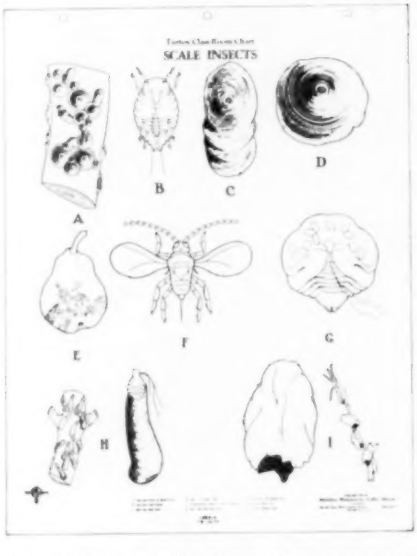

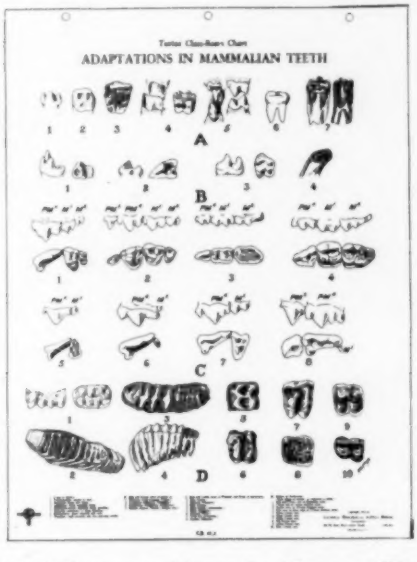

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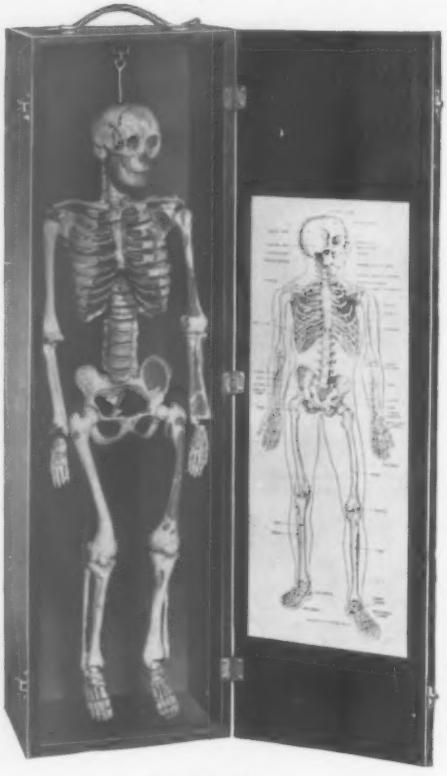

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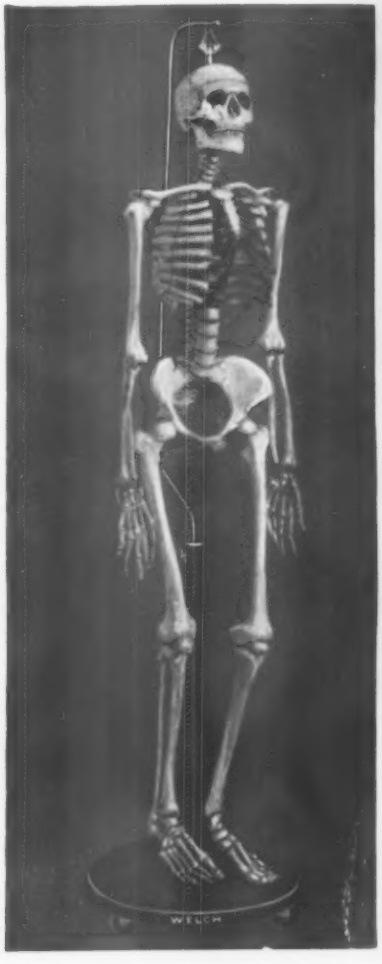

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